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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/614,535	07/07/2003	Donald K. Mitchell	MICRE-012XX	9121

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EXAMINER	
WILLIAMS, DON J	

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 07/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/614,535	MITCHELL, DONALD K.	
	Examiner	Art Unit	
	Don Williams	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☒ Claim(s) *22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-22 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thorburn et al in view of Ishizuka et al (5,569,913).

As to claim 1, Thorburn et al disclose an optical encoder sensor head (110) for use with a reflective multi-track encoder scale (160), with a quasi-monochromatic light source (112) disposed on a surface of a planar substrate (111) facing the encoder scale (160); a plurality of optical detectors (120, 140) disposed on the surface of the substrate (111) at respective locations defining respective optical paths (102, 103) between the optical detectors (120, 140) and respective tracks (162, 166) of the encoder scale (160). Thorburn et al fail to disclose an optical wavefront dividing element disposed between the substrate and the encoder scale. Ishizuka et al disclose a transparent substrate disposed between the scale and a substrate comprised of a light source and a plurality of photodetectors. The transparent substrate constitutes wavefront-split diffraction

gratings for splitting a beam of light. It would have been obvious for one ordinary skill in the art to modify Thorburn et al to include wavefront split diffraction gratings to improve the splitting of a cone of light into separate light beams which incident on the diffraction grating of the scale and is diffracted and reflected into light orders that are directed toward the corresponding detector elements allowing the distance between the scale and the encoder to be measured, (see figure 2, column 2, lines 60-67, column 3, lines 1-44).

As to claim 2, the modified Thorburn et al disclose an optical encoder sensor head (101) with a vertical cavity surface emitting laser (VCSEL) (112), (see figure 1, figure 2, paragraph [0027], paragraph [0028].

As to claim 3, the modified Thorburn et al disclose an optical encoder sensor head (101) wherein the quasi-monochromatic light source (112) emits an expanding cone of light (102), (see figure 1, figure 2, paragraph [0028].

As to claim 4, the modified Thorburn et al disclose an optical encoder sensor head (101) with the plurality of optical detectors (120, 140) disposed on opposite sides of the light source (112), (see figure 1, figure 2A, figure 2B, paragraph [0027].

As to claim 5, the modified Thorburn et al disclose an optical encoder sensor head (101) wherein the substrate (111) is a first substrate. The modified Thorburn et al fail to disclose a diffractive optical element (DOE) disposed on a warfront dividing element. Ishizuka et al dispose a transparent substrate having wavefront split diffraction gratings. It would have been obvious for one ordinary skill in the art to further modify Thornburn et al to include the wavefront split diffraction grating as disclosed by Ishizuka

et al to improve the separation of reflected-diffracted light orders to allow an accurate location of the scale to be detected, (see figure 2, column 2, lines 60-67, column 3, lines 1-40).

As to claim 6, the modified Thorburn et al disclose an optical encoder sensor head (101) wherein the DOE (166) has a layer of material having a thickness selected to introduce a substantially half-wave delay in light passing through the DOE (166), (see figure 1, figure 5, paragraph [0035].

As to claim 7, the modified Thorburn et al disclose an optical encoder sensor head (101) with a grating having a square wave profile, (see figure 1).

As to claim 8, the modified Thorburn et al disclose an optical encoder sensor head (101) with a grating having a triangle wave profile, (see figure 2B, figure 3, lines 1-67).

As to claim 9, the modified Thorburn et al disclose an optical encoder sensor head (101) with a grating having a-sine wave profile (paragraph [0036].

As to claim 10, the modified Thorburn et al disclose an optical encoder sensor head (101) with the second substrate (16) including a plurality of windows (166), each window (166) lying along a corresponding one of the optical paths between the tracks on the encoder scale (162) and the detectors (120, 140), (see figure 2B, figure 2C, paragraph [0027].

As to claim 11, the modified Thorburn et al disclose an optical encoder sensor head (101) with the second substrate (161) having an optically transparent material with

a low coefficient of thermal expansion, (see figure 3A, figure 3B, figure 3C, paragraph [0029].

As to claim 12, the modified Thorburn et al disclose an optical encoder sensor head (101) wherein the second substrate (161) is coated with optically transparent material having an index of refraction n different from that of air, (see figure 3A, 3B, 3C, paragraph [0029].

As to claim 13, the modified Thorburn et al disclose an optical encoder sensor head (101) the optically transparent material (164) comprises a dielectric material, paragraph [0029].

As to claim 14, the modified Thorburn et al disclose an optical encoder sensor head (101) wherein the dielectric material has a refractive index close to the refractive index of the second substrate (161), (see paragraph [0029]).

As to claim 21, the modified Thorburn et al disclose a sensor head (101) with the tracks (162, 166) of the encoder scale (160) include a first track (166) having a diffractive optical element for forming a line image indicative of an index location of the scale (160), and a second track (162) having a diffraction grating for forming a diffraction pattern indicative of incremental position of the scale (160), (see figure 1, paragraph [0027], figure 3A, 3B, 3C, paragraph [0029].

As to claim 15, the modified Thorburn disclose an optical encoder including a sensor head (101), the substrate having a light source (112) and first and second optical detectors (120, 140) disposed thereon; an encoder scale (160) including first and second tracks (162, 166), the encoder scale (160) being disposed opposite the sensor

head (110), a light beam (102) emitted by the light source (112). The modified Thorburn et al fail to disclose an optical wavefront dividing element disposed between the substrate and the encoder scale. Ishizuka et al disclose a transparent substrate disposed between the scale and a substrate that is comprised of a light source and a plurality of photodetectors. The transparent substrate constitutes wavefront split-diffraction gratings for splitting a beam of light. It would have been obvious for one ordinary skill in the art to modify Thorburn et al to include wavefront split diffraction gratings to improve the splitting of a cone of light into separate light beams which incident on the diffraction grating of the scale and is diffracted and reflected into light orders that are directed toward the corresponding detector elements allowing the distance between the scale and the encoder to be measured, (see figure 2, column 2, lines 60-67, column 3, lines 1-44).

As to claim 16, the modified Thorburn et al disclose a sensor head (101) including a substrate (111) having a light source (112) and a first and second optical detectors (120, 140), an encoder scale (160) including first and second tracks (162, 166), and first and second beam (102, 103), (see figure 1, figure 2A, figure 2B, figure 2C, paragraph [0027]. The modified Thorburn et al fail to disclose an optical wavefront dividing element disposed between the substrate and the encoder scale. Ishizuka et al disclose a transparent substrate disposed between the scale and a substrate that is comprised of a light source and a plurality of photodetectors. The transparent substrate constitutes wavefront-split diffraction gratings for splitting a beam of light. It would have been obvious for one ordinary skill in the art to modify Thorburn et al to include

wavefront split diffraction gratings to improve the splitting of a cone of light into separate light beams which incident on the diffraction grating of the scale and is diffracted and reflected into light orders that are directed toward the corresponding detector elements allowing the distance between the scale and the encoder to be measured, (see figure 2, column 2, lines 60-67, column 3, lines 1-44).

As to claim 17, the modified Thorburn et al disclose a sensor head (110a) and an encoder scale (160). The modified Thorburn fail to disclose a wavefront dividing element disposed on a substrate. Ishizuka et al disclose wavefront-split diffraction grating disposed on a transparent substrate. It would have been obvious for one ordinary skill in the art to further modify Thorburn et al to position the beam divider transparent substrate having wavefront-split diffraction gratings between the sensor head and the encoder scale to improve the splitting of the cone of light into reflected and diffracted orders which are received by the detector to determine the relative position of the scale.

As to claims 18, 19, the modified Thorburn et al disclose a substrate (111) of the sensor head (110), (see figure 2A, paragraph [0027]). The modified Thorburn et al fail to disclose the substrate of the beam divider. Ishizuka et al disclose a transparent substrate. It would have been obvious for one ordinary skill in the art to further modify Thorbun et al to include a transparent substrate of the beam divider aligned relative to the sensor head as disclosed by Ishizuka et al to improve the splitting of the cone of light into reflected and diffracted light orders which are received by the detector to determine the relative position of the scale.

As to claim 20, the modified Thorburn et al disclose a sensor head (110) for use in an optical encoder, the encoder including a scale (160), the scale (160) being movable relative to the sensor head (110) along a first axis, a distance between the scale (160) and the sensor head (110) as measured in a direction perpendicular to the first axis being constant, the encoder generating a signal representative of a position of the scale (160) relative to the sensor head (110), the scale (160) including a first track (162), and a second track (166), the sensor head (110) comprising a substrate (111), a light source (112), a first optical detector(140), a second optical detector (120), (see figure 2A, paragraph [0027]. Thorburn et al fail to disclose an optical wavefront dividing element disposed between the substrate and the encoder scale. Ishizuka et al disclose a transparent substrate disposed between the scale and a substrate comprised of a light source and a plurality of photodetectors. The transparent substrate constitutes wavefront-split diffraction gratings for splitting a beam of light. It would have been obvious for one ordinary skill in the art to modify Thorburn et al to include wavefront split diffraction gratings to improve the splitting of a cone of light into separate light beams which incident on the diffraction grating of the scale and is diffracted and reflected into light orders that are directed toward the corresponding detector elements allowing the distance between the scale and the encoder to be measured, (see figure 2, column 2, lines 60-67, column 3, lines 1-44).

Allowable Subject Matter

Claim 22 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The prior art discloses all the limitations as set forth above, but lacks a clear teaching of determining the periodic grating of the wavefront dividing element with a period P satisfying the following relationship: $\tan(\lambda/P) = Y+d/2(2D-Z)$.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Don Williams whose telephone number is 571-272-8538. The examiner can normally be reached on 8:30a.m. to 5:30a.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 571-272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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